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THE SEQUENCE OF SCIENCE IN THE JUNIOR AND SENIOR HIGH SCHOOL

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THE history of secondary school science teaching in North Carolina is not very bright in retrospect, but it is not far different from the history of science teaching in the schools all over the United States. Everywhere we hear the questions put, "Has science made good?" "What is the matter with science teaching?" But if we look back into the history of science teaching in this country it is not difficult to see why science has not "made good." Science teachers in the secondary schools have tried to outdo their college professors in the rigidity of their courses and the unrelated quality of their experiments to life. The pupil has been lost sight of in the college demand for 40 experiments in physiology or 50 experiments in biology. The children have lost sight of the goal toward which they are trending in the maze of directions which have been given them to help them reach that goal. And this in the name of science!

THE HISTORY OF SCIENCE TEACHING

In order to understand how these conditions come about let us look back at the history of biology teaching in the secondary schools of this country. Botany was first introduced in the academies in 1800, and in 1825 zoology found a place. Reasons given for the introduction of these sciences were "they made for utility, recreation, and for cultivation of the aesthetic feelings." Such courses were purely natural history given largely from text-books with little or no laboratory work. This natural history period was followed by a second period, that of comparative anatomy and plant analysis. This period lasted roughly from 1870 to 1890. Asa Gray, the great Harvard botanist, had made a profound impression on his students, many of whom were young men expecting to become teachers in secondary schools. Gray's methods, however, did not come into general use in the secondary schools until almost 25 years after he had done his college teaching. It shows, all too well, how the secondary schools follow directly the method of the colleges without thinking of the capability or interests of the student.

The third period, which might be called the laboratory study of types began in 1890. Here evolution was the keynote. First-hand study in the laboratory of a large number of plants and animals was insisted on and the laboratory manual found an important place in the secondary schools. I have corrected 40 different manuals for the secondary school which came out between 1890 and 1900. During this period the report of The Committee of Ten recommended unit courses of one year in Botany, Zoology, and Psychology. Another college standard imposed by specialists who placed subject matter first and pupils last, if they thought about them at all. Laboratory work was emphasized in the insistence of three hours of laboratory to one of recitation. College methods rode rampant and the poor pupils suffered still more than under the more interesting collecting work of the previous period.

This method of study was followed by a revamping of plant and animal physiology of the college type so that from 1900 to 1910 we find secondary schools giving courses in plant and animal physiology. For the first time the public now became interested in the science courses, or at least began to demand a hearing. This was a period of great practical discovery in biological science. The work of Walter Reed and his associates on yellow fever was making possible the building of the Panama Canal. The work of Levarau, Ross, Grassi, and Manson had made a knowledge of malaria mean something to the everyday man. And so a reflection of public demands became evident in the numerous courses of hygiene and physiology which found their way into the secondary schools during this period. But the trend during this time was physiological rather than hygienic, so slow are teachers to awake to the demands of the world around them.

A fifth period from 1910 to 1920 I have called a period of correlation, unification, and application.

Ideas instead of types are now becoming paramount. It is the beginning of real biology teaching. Although many of the elementary biologies which appeared are real misnomers, being nothing but collections of botanical, zoological, and physiological exercises, yet the trend nevertheless is toward unification. The application of biological principles to human welfare, personal and community hygiene, and civic applications are increasingly seen. The pragmatism of the age demands that the subject be worth while to the pupil, and the pupil's demands are pragmatic.

If I were to prognosticate a sixth decade from 1920 to 1930, I would say that during this period we would see the rise of elementary science or general science in the junior high school with a definite and concrete attack through problems and projects in which the pupil has a definite interest.

THE NEW POINT OF VIEW

Those of us who know the work done by the committee of reorganization of science in the N. E. A. realize that educators the country over are beginning to think of the child rather than the subject matter. The contribution of science toward health, human membership, vocational preparation, citizenship, the use of leisure time, and ethical character building has well been established. Nature exacts her penalties upon those who disobey her laws, and gives legitimate returns to those who obey and use them properly. The development of specific instruction, habits, and abilities based on experiences found in the laboratory will do more toward making thinking citizens of our young people than almost any other material that the school curriculum will offer. For it is training in the problems of everyday life that the world needs today as never before.

SCIENCE IN EVERYDAY LIFE

Do you ever stop to think that we are living at a time when science has done more to make everyday life comfortable than at any other time in the world's history? We sleep at night in a bed, the springs and parts of which were made by machinery, and the covers of which were woven by complicated processes; we wash with soap made by chemical formulae and mixed in a factory full of complicated machines. We eat prepared breakfast foods, and cook on gas, coal or wood stoves made by machines. Every part of our waking and sleeping hours in some way comes in contact with machines, and yet how few of us actually know very much about the science which underlies all of these and many other useful and beneficial inventions. Have you ever thought of some of the things which come to be thought common since the fathers and mothers of the children we teach were born? X-rays, radium, the pianola, liquid air, submarines, gas engines, sky scrapers, harvesters, vacuum brakes, fireless cookers, vacuum bottles, vacuum cleaners, color photography, smokeless powder, electric locomotives and street cars, airplanes, hydroplanes, motorcycles, gas mantels, automobiles, carpet sweepers, asphalt paving, safety matches, pneumatic appliances, moving pictures, typewriters and adding machines, wireless telegraphy, pneumatic mailing tubes, electric heating and cooking apparatus, turbines, paper towels, electric lighting, reinforced concrete, sanitary drinking fountains and cups, and a great many other things which we have come to look upon as almost necessities of life.

In the midst of such a life as this our children are growing up. Science beckons to them from every side. In every device used at home for comfort and better living, science speaks. The telephone and telegraph, the trolley and the automobile, the airplane and submarine, have all become part and parcel of their daily lives. Many of the wonders of this age of science cannot fail to interest the average boy or girl if he or she is made to see just how this or that particular scientific mechanism affects them directly. Children of from twelve to fifteen years of age have interests that are usable in the class-room, providing such interests are properly directed, and although the interests of boys and girls may differ, yet there are wonders enough for all, and things may be found that are vital to both of the sexes.

THE SEQUENCE OF SUBJECT MATTER

The sequence of science in the elementary and secondary schools should, therefore, receive our careful attention. With the reorganization of the school curricula and with the introduction of the junior high school a very serious problem is placed upon the high school teachers of science. If the junior high school is organized on the so called six, three, three plan undoubtly general science, with a broad and elastic treatment of science problems, should come in the first two years of the junior high school, followed by elementary biology in the last year. This would allow in the senior high school more intensive courses in chemistry, physics, with applied sciences coming in the last year. I would appeal for the introduction of more social science, especially would an elementary course in sociology be of real value in the last year of high school. In the four-year high school the plan would be somewhat modified. Here we would expect to find elementary science occurring the first year followed by a year of general biological science. The last two years of high school would then give option for chemistry, physics, and applied social science. But in no case ought a pupil to pass through the junior high school and senior high school without having a broad foundation of science with some aspect treated in each year of his course.

Since the social side of elementary science ought to be emphasized probably the most effective treatment would be in two cycles. The first cycle should be based on a knowledge of science in the home and its immediate environment; while the second would take up communal life in its relation to science. Science of the home might well include the following topics in approximately the sequence given; the essentials of an ideal home, its natural resources, including treatment of the hygienic demands for pure air, water and food; the proper removal of wastes, the elimination of household pests, and the danger from germs. A cycle of work with projects on heat in the home including the various heating systems, fire prevention and the uses of clothing might follow. Then would follow an elementary treatment of lighting, artificial and natural, with emphasis on the care of the eyes. Home construction and decoration, planning the home grounds and work with home gardens are projects which naturally follow. Science as it works through the various simple machines of the home including the use of electricity, might then be treated. The first cycle might well end with the relation of science to various forms of recreation such as kite-making and flying, boat-building and sailing, the making of motors and airplanes, etc.

The second year of work might well begin with discussions of the ideal community in its various phases and the factors which make it a good place to live in. The natural resources of the community should be emphasized including water power, climate, and weather. In this relation the work of the Weather Bureau should be studied. This could be followed by projects on the relation of water to food supplies, its sources, and then to the water supply of communities, giving special attention to modern methods of purification. Since our science should be essentially social, a discussion of the organization of city government should be introduced. The work of various departments, especially that of the Health Department, should be stressed. The Pure Food and Drug Act; prevention of disease; quarantine; natural and acquired immunity; the relation of insects to disease; the disposal of city wastes, and the protection of life and property are all topics worthy of discussion from a scientific standpoint. Here too, is an excellent opportunity for dwelling upon the moral obligations of individuals in society. Our boys and girls are growing up today with far too little on the ethical and spiritual needs in citizenship.

City organization leads us naturally to city lighting, and thus to transportation in its various phases. Finally, such a course ought to lead the pupil through practical examples of plant breeding and eugenics to his introduction of biology. The cycle of biological study which should take up the third year of the sequence would not be a course in botany or zoology but would be primarily biology. Function should be emphasized throughout and should concern itself with the outstanding essentials of biology as seen from a sociological standpoint. It must naturally differ as to construction and laboratory methods for it must differ according to the types of community for which the course is given. For no course in biology in secondary schools should have existence today unless it can have direct bearing on the lives of the pupils. Such courses as we have outlined may confidently be expected to do their part in the great problems of Americanization that lie before us in these post-war days.

NATIONAL PARENT--TEACHERS ASSOCIATION

THE 24th Annual Convention of the National Congress of Mother and Parent-Teacher Associations was held in the Assembly Room, State Capitol, Madison, Wisconsin, June 3 to 8, 1920. It was one of the largest Conventions ever held and was marked by a noteworthy spirit of co-operation and progressiveness. In Wisconsin, as in many other states, the Parent-Teacher Association work is being vigorously pushed by the State Education Department.

At the triennial election of officers, the following were chosen: President, Mrs. Milton P. Higgins, Worcester, Massachusetts; Corresponding Secretary, Mrs. George B. Chandler, Rocky Hill, Connecticut; Recording Secretary, Mrs. Joseph Garibaldi, Charlotte, N. C.; Treasurer, Mrs. Hubert N. Rowell, Berkeley, Calif.; Auditor, Mrs. Charles H. Remington, East Providence, R. I.; Historian, Mrs. Giles Scott Rafter, Washington, D. C.

Report showed an increase in membership for the year April, 1919, to April, 1920, of more than 90,000. The total membership today is over 218,000. The goal for the coming year is 1,000,000 members.